TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371	ATTORNEY'S DOCKET NUMBER SON-2166/SOH
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INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP01/06547	30 July 2000	31 July 2000

TITLE OF INVENTION
LIQUID CRYSTAL DISPLAY PANEL AND PRODUCTION METHOD OF THE SAME AND LIQUID CRYSTAL DISPLAY APPARATUS

APPLICANT(S) FOR DO/EO/US
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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(I).

4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ☒ Amendment to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendment has NOT expired.
   d. ☒ have not been made and will not be made.

8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern either document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. ☐ A FIRST preliminary amendment.

☐ A SECOND or SUBSEQUENT preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☐ Other items or information.

U.S. APPLICATION NO (If known, see 37 CFR 1.5) 10/089230	INTERNATIONAL APPLICATION NO PCT/JP01/06547	ATTORNEY'S DOCKET NUMBER SON-2166/SOH

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CRF 1.49(a)(1)-(5): Search Report has been prepared by the EPO or JPO		
International preliminary examination fee paid to USPTO (37 CRF 1.482)		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$ 890.00**	
Surcharge of $130.00 for furnishing the oath or declaration later than ☒ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.49(e)).	**$ 0.00**	

Claims	Number Filled	Number Extra	Rate		
Total Claims	10	0	9/18	**$ 0.00**	
Independent Claims	7	4	42/84	**$ 336.00**	
Multiple dependent claim(s) (if applicable)					
TOTAL OF ABOVE CALCULATIONS			=	**$1226.00**	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28)				**$**	
SUBTOTAL			=	**$1226.00**	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.49(f)).			+	**$**	
TOTAL NATIONAL FEE			=	**$1226.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate sheet (37 CFR 3.28, 3.31). $40.00 per property			+	**$**	
TOTAL FEES ENCLOSED			=	**$1226.00**	
				Amount to be refunded	**$**
				Charged	**$1226.00**

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 18-0013 in the amount of $1226.00 to cover the above fees. A duplicate of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **18-0013**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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DESCRIPTION

LIQUID CRYSTAL DISPLAY PANEL AND PRODUCTION METHOD OF THE SAME AND LIQUID CRYSTAL DISPLAY APPARATUS

TECHNICAL FIELD

The present invention relates to a liquid crystal display panel of an active matrix display, to be used connected to an external horizontal drive circuit or vertical drive circuit, provided with an aging circuit on a substrate thereof so that aging can be performed at the substrate of the liquid crystal display panel alone without connecting to the external horizontal drive circuit or vertical drive circuit, and a method of producing the same.

Further, the present invention relates to a liquid crystal display apparatus provided with a horizontal drive circuit as an external circuit of a liquid crystal display panel.

BACKGROUND ART

Conventionally, in a large-sized liquid crystal display apparatus for an active matrix display, a horizontal drive circuit and vertical drive circuit incorporating driver ICs for applying a predetermined voltage to the pixels are provided by TAB (tape automated

bonding) or COG (chip on glass) at the outside of the substrate of the liquid crystal display panel. Further, in a small-sized liquid crystal display apparatus, the horizontal drive circuit is provided outside the substrate of the liquid crystal display panel, while the vertical drive circuit is provided integrally in the substrate of the liquid crystal display panel.

Aging is performed for displaying a predetermined image on the liquid crystal display panel to examine for defects in the panel itself before assembling the liquid crystal display panel into a liquid crystal display apparatus.

However, with a liquid crystal display panel to which external drive circuits are connected by TAB, COG, etc., it is not possible to display an image unless the external drive circuits are connected to the liquid crystal panel. Therefore, aging cannot be performed by the liquid crystal panel alone.

Therefore, there is an inconvenience that drive circuits have to be incorporated in advance as a module in order to perform aging. Furthermore, when the aging reveals any defect, reuse of the TAB, COG, or other circuits incorporated as a module requires that they be removed from the defective panel. This is troublesome. Thus, there was a problem that the work efficiency of

aging was low in such liquid crystal display panels.

Also, as explained above, in a large-sized liquid crystal display apparatus for an active matrix display, the horizontal drive circuit and vertical drive circuit incorporating driver ICs for applying a predetermined voltage to the pixels are provided outside the substrate of the liquid crystal display panel by TAB, COG, etc. In this case, there is normally a one-to-one correspondence between the outputs of the external driver IC and source lines of the liquid crystal display panel. The output voltages from the output terminals of the driver ICs are supplied as they are to the corresponding source lines.

On the other hand, in a small-sized liquid crystal display apparatus for active matrix display, a time sharing drive method (selector method) is employed, the horizontal drive circuit is provided as an external circuit, and the vertical drive circuit is integrally provided in the substrate of the liquid crystal display panel.

In the time sharing drive method, a plurality of source lines are treated as one unit, and signals given to the plurality of source lines in a unit are output from the driver IC in a time series. In a liquid crystal display panel, a plurality of source lines are treated as one unit and a time sharing switch is provided, and

signals in a time series output from a driver IC are divided in time by the time sharing switch and successively given to the plurality of source lines.

According to the time sharing drive method, the outputs of the driver IC of the external horizontal drive circuit and source lines of the liquid crystal display panel are not in a one-to-one correspondence. For example, a write operation is performed on three source lines by one output line of the driver IC. Accordingly, the number of output pins of the driver IC can be reduced by using the time sharing drive method.

However, in a medium-sized to small-sized liquid crystal display panel used in a PDA etc., the time sharing drive method causes the following problems:

First, since a horizontal writing time is divided in the time sharing drive method, a sufficient writing time to the source lines from the driver IC cannot be secured.

Second, a horizontal drive frequency of the driver IC has to be made higher in accordance with the number of divisions of one horizontal scanning period. For example, when dividing one horizontal scanning period into three equal portions, the driver IC has to operate at three times the horizontal drive frequency of the liquid crystal.

Third, since a pulse is required to make the time

sharing switch operate and data has to be rearranged to change the order of writing to the source lines, medium-sized to small-sized liquid crystal display panels require a large power consumption and a memory for rearranging data. These are also problems.

On the other hand, a drive method relying on external circuits for both of the horizontal drive circuit and vertical drive circuit suffers from the problem that with medium-sized to small-sized liquid crystal display panels, it is not possible to take out terminals from one side of the panels. Therefore, the problems arise that the outside shape of a module becomes large and assembly of the module becomes complicated. Furthermore, the number of connection points of the liquid crystal display panel and the outside becomes large, so the probability of a connection defect arising becomes higher.

DISCLOSURE OF INVENTION

A first object of the present invention is to provide a liquid crystal display panel enable panel defects to be found by aging by a panel substrate alone even when image display becomes possible by connecting drive circuits outside and capable realizing a high quality display panel at a low cost and a method of

producing the same.

A second object of the present invention is to provide a liquid crystal display apparatus capable of being provided with a horizontal drive circuit as an external circuit without using a time sharing drive method in medium- to small-sized liquid crystal display apparatuses used for PDAs etc.

The present inventors discovered that aging of a liquid crystal panel to which external drive circuits are to be connected can be performed without connecting external drive circuits to the liquid crystal display panel by providing in a substrate of the liquid crystal display panel an aging circuit able to supply signals to a plurality of lines at one time to form a simple image and that consequently the work efficiency of aging can be improved.

Namely, to attain the above objects, the present invention provides a liquid crystal display panel provided with an active matrix display area, a vertical drive circuit, and a horizontal aging circuit for supplying signals to source lines at one time on a substrate of the liquid crystal display panel and provided with a horizontal drive circuit connected externally.

Also, the present invention provides a liquid

crystal display panel provided with an active matrix display area, a horizontal drive circuit, and a vertical aging circuit for supplying signals to a plurality of gate lines at one time on a substrate of the liquid crystal display panel and provided with a vertical drive circuit connected externally.

Furthermore, the present invention provides a liquid crystal display panel provided with an active matrix display area, a horizontal aging circuit for supplying signals to a plurality of source lines at one time, and a vertical aging circuit for supplying signals to a plurality of gate lines at one time on a substrate of the liquid crystal display panel and provided with a horizontal drive circuit and vertical drive circuit connected externally.

Also, as a method of producing the above liquid crystal display panel, the present invention provides a method of producing a liquid crystal display panel comprising forming a horizontal aging circuit or a vertical aging circuit in a process of forming an active matrix display area on a substrate.

Also, to attain the above objects, the present invention provides an active matrix type liquid crystal display apparatus, wherein a vertical drive circuit is formed integrally with a liquid crystal display area on a

glass substrate using low temperature polySi TFTs, a horizontal drive circuit is connected to a liquid crystal display panel substrate by COG, and output terminals of a driver IC constituting the horizontal drive circuit and source lines are in a one-to-one correspondence.

According to the liquid crystal display apparatus of the present invention, since a time sharing driving method is not used and the output terminals of a driver IC constituting the horizontal drive circuit and source lines are in a one-to-one correspondence, all of a horizontal scanning period can be used for writing to one source line and the image quality can be improved. Also, the output necessary for the driver IC of the horizontal drive circuit can be made smaller compared with that in a time sharing driving method, and also it is not necessary to provide a time sharing switch, so a lower power consumption of the overall system can be achieved. Furthermore, rearrangement of signals and a memory required in the time sharing driving method become unnecessary in the present invention.

Furthermore, by providing a horizontal drive circuit having a high frequency, which is strongly required not to have any unevenness in characteristics, as an external circuit, the quality of the horizontal drive circuit can be checked before mounting it on the liquid crystal

display panel, so the yield of liquid crystal display panels can be improved and a high quality product can be provided at a lower cost.

Also, compared with the method relying on external circuits for both of the horizontal drive circuit and the vertical drive circuit, the number of connection points are small, so the yield of the products can be improved.

Since the vertical drive circuit can be formed integrally on the substrate of the liquid crystal display panel, the frame can be made smaller compared with the method relying on external circuits for both of the horizontal drive circuit and the vertical drive circuit.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a view of a circuit layout of a liquid crystal display panel according to the present invention.

FIG. 2 is a view of an example of the configuration of a horizontal aging circuit according to the present invention.

FIGS. 3A to 3E are timing charts at the time of aging.

FIG. 4 is a circuit diagram of a example of the configuration of a pixel cell of an active matrix display area.

FIG. 5 is a view of another example of the

configuration of a horizontal aging circuit according to the present invention.

FIG. 6 is a view of another example of a circuit layout of a liquid crystal display panel according to the present invention.

FIG. 7 is a block diagram of a liquid crystal display apparatus according to the present invention.

FIG. 8 is a view of another specific example of a circuit layout of a liquid crystal display apparatus in FIG. 7.

BEST MODE FOR CARRYING OUT THE INVENTION

Below, the present invention will be explained with reference to the drawings. Note that identical reference numbers in the drawings indicate identical or equivalent components.

FIG. 1 is a view of a circuit layout of a liquid crystal display panel according to the present invention.

In the liquid crystal display panel 1, as shown in FIG. 1, a vertical drive circuit (VDRV) 4, a horizontal aging circuit (HAG) 5, a first pad region 6 having narrow pitches, and a second pad region 7 are provided on a glass substrate 3 around an active matrix display area (AMDAS) 2 configured by using TFTs (thin film transistors).

Here, the vertical drive circuit 4 successively gives scanning pulses to the gate lines Lg and selects pixels in units of lines to perform vertical scanning.

The horizontal aging circuit 5 supplies signals to a plurality of source lines Ls at one time.

The horizontal aging circuit 5, for example, as shown in FIG. 2, is provided with PMOS switches PSW, comprised of p-channel MOS (PMOS) transistors whose gates are connected to a control signal line LCTL, between all source lines Ls and one signal line LSG and is configured so that all source lines Ls can be driven by one interconnection.

Note that since the horizontal aging circuit 5 is provided on a seal region of the liquid crystal display panel 1, there is no disadvantage of the external size becoming larger due to formation of the horizontal aging circuit 5.

The first pad region 6, as shown in FIG. 1, has mounted on it the horizontal drive circuit (HDRV) 8 in a TAB form at the time of actual use. Therefore, the first pad region 6 is provided with several hundreds of pads at pitches of about 80 μm corresponding to the source lines for the number of horizontal dots of the active matrix display area 2 and interconnections for vertical driving.

On the other hand, the second pad region 7

corresponds to the horizontal aging circuit 5 which drives all source lines Ls with one interconnection and is provided with not more than 10 pads including interconnections for vertical driving at pitches of about 500 μm.

Thus, the pads and external horizontal drive circuit can be easily connected by bringing them into abutment by the naked eye.

As an example of the configuration of such a second pad region 7, for example, the following may be mentioned:

1 pin = VDD (vertical drive circuit use power source)

2 pin = GRD

3 pin = VSS2 (vertical drive circuit use negative power source)

4 pin = VST (vertical drive circuit use signal)

5 pin = VCK (vertical drive circuit use signal)

6 pin = ENB (vertical drive circuit use signal)

7 pin = VCOM (counter potential)

8 pin = SIG (aging signal)

9 pin = switching between actual use mode (DC VDD:9V) and aging mode (DC VSS2:-6.5V)

FIGS. 3A to 3E are timing charts for when performing aging on this liquid crystal display panel 1. The timing

charts indicate a case of VCOM inversion driving wherein a counter potential (VCOM) is inverted for every horizontal scanning period.

Note that FIG. 3C to FIG. 3E show VCOM and SIG switching between a solid line and dotted line for every field scanning period.

FIG. 4 is a circuit diagram of an example of the configuration of a pixel cell of an active matrix display area.

The pixel cell 10 is, as shown in FIG. 4, comprised of a TFT 11, a liquid crystal element (LC) 12, and a counter electrode (VCOM) 13. Such pixel cells are arranged in a matrix in the active matrix display area.

In the pixel cell 10, a gate of the TFT 11 is connected to a gate line Lg, a source is connected to a source line Ls, and a drain is connected to a pixel electrode.

In a pixel cell configured as such, as shown in FIG. 4, the difference between the aging signal SIG supplied to the source line Ls and the counter potential VCOM becomes the potential applied to the liquid crystal, so, as shown in FIG. 3C to FIG. 3E, by cyclically changing the VCOM and SIG for alternating driving, polarization of liquid crystal molecules can be prevented and the image quality can be improved.

As explained above, according to the liquid crystal display panel 1, the horizontal aging circuit 5 and the vertical drive circuit 4 can be driven for white display and black display by using only the second pad region 7, i.e., even without using the first pad region 6, so aging for examining for defects of the panel itself can be performed.

Accordingly, it becomes unnecessary to mount the horizontal drive circuit 8 before the aging, and the trouble of removing the horizontal drive circuit from a liquid crystal display panel judged to be defective by the aging is also eliminated.

As a result, the work efficiency of aging can be remarkably improved. Furthermore, since aging can be easily performed only by using the second pad region 7, the productivity of liquid crystal display panels can be improved.

The present invention can be modified in various ways so long as no external drive circuit is mounted and an aging circuit is provided on a substrate of the liquid crystal display panel for enabling aging.

For example, in the liquid crystal display panel 1 in FIG. 1, the horizontal aging circuit 5 may be configured as shown in FIG. 5.

In a horizontal aging circuit 5a in FIG. 5, source

lines are gathered together for each of the three primary colors of R (red), G (green), and B (blue).

By using the horizontal aging circuit 5a, a monochrome raster can be displayed. Furthermore, by introducing a horizontal shift register circuit etc. to the horizontal aging circuit, a more complex image can be displayed at the time of aging.

In the aging circuit 5 shown in FIG. 2, the source lines Ls are provided only with PMOS switches, but it is also possible to provide as switching means of the source lines Ls only NMOS switches comprised of n-channel MOS (NMOS) transistors or to provide CMOS switches.

Also, the mode of connection of the external horizontal drive circuit and liquid crystal display panel is not limited to TAB. It may be COG etc. as well.

FIG. 6 is a view of an example of the configuration of a circuit layout of a liquid crystal display panel when connecting an external drive circuit by COG.

Furthermore, as shown in FIG. 6, when a horizontal drive circuit is connected as an external circuit to the liquid crystal display panel, a horizontal aging circuit is provided on the substrate of the liquid crystal panel as explained above, while when a vertical drive circuit is connected as an external circuit to the liquid crystal display panel, a vertical aging circuit is provided on

the substrate of the liquid crystal display panel in the same way.

Also, when both of a horizontal drive circuit and a vertical drive circuit are connected as external circuits, both of a horizontal aging circuit and a vertical aging circuit are provided on the substrate of the liquid crystal display panel.

In this case, as a vertical aging circuit, one which gathers together a plurality of gate lines by switching means such as CMOS switches, NMOS switches, or PMOS switches and supplies signals to the gathered lines is provided.

As a method of producing a liquid crystal display panel of the present invention provided with a horizontal aging circuit or a vertical aging circuit or both on a substrate of the liquid crystal display panel, it is sufficient to also form the horizontal aging circuit or vertical aging circuit in the process of forming the active matric display area on the substrate by the following well known method.

Accordingly, the liquid crystal display panel of the present invention can be produced by a production method similar to that of a conventional liquid crystal panel for active matrix display, so there is no disadvantage of an increase of steps by providing the horizontal aging

circuit or vertical aging circuit.

As explained above, according to the present embodiment, instead of an external horizontal drive circuit or vertical drive circuit, an aging circuit is provided on the substrate of the liquid crystal display panel, therefore it is possible to perform aging and find potential panel defects by the substrate of the liquid crystal display panel alone. Therefore, a high quality liquid crystal display panel can be supplied at a low cost.

Next, an explanation will be given of a liquid crystal display apparatus wherein a vertical drive circuit is integrally formed with the liquid crystal display area by using low temperature polycrystalline silicon (polySi) TFTs, a horizontal drive circuit is connected to a liquid crystal display panel substrate by COG, and the output terminals of a driver IC composing the horizontal drive circuit and source lines are in a one-to-one correspondence.

FIG. 7 is a block diagram of a liquid crystal display apparatus 20 of an embodiment of the present invention.

The liquid crystal display apparatus 20 comprises a liquid crystal display area (LDA) 22 formed on a glass substrate 21 by using low temperature polySi TFT, a

vertical drive circuit 23 formed integrally with the liquid crystal display area 22 by using low temperature polySi TFTs, and an external horizontal drive circuit (HDRV) 24 mounted by COG.

FIG. 8 is a view of a specific circuit example of the liquid crystal display apparatus 20 of FIG. 7.

The source lines of the liquid crystal display apparatus 20 are driven by a shift register circuit (SFT) 25, a sampling circuit (SMPL) 26, a latch circuit (LTC) 27, a digital/analog conversion circuit (DAC) 28, and an output buffer circuit (BUF) 29 configured in the driver IC of the COG connected horizontal drive circuit 24.

Here, the shift register 25 successively outputs horizontal scanning pulses to perform horizontal scanning.

The sampling circuit 26 performs successive sampling on a digital image data input here in correspondence with the horizontal scanning pulses from the shift register circuit 25. The image data sampled in the sampling circuit 26 is stored for an amount of one horizontal period in the latch circuit 27.

In the DAC 28, digital data of one horizontal period output from the latch circuit 27 is converted to an analog signal and output. The output from the output buffer circuit 29 is led to the source lines Ls of the

liquid crystal display panel as it is. The output to the source lines Ls continues for one horizontal scanning period.

Consequently, in the liquid crystal display apparatus 20, the output terminals of the driver IC constituting the horizontal drive circuit 24 and the source lines are in a one-to-one correspondence.

On the other hand, the vertical drive circuit 23 opens the TFT switch 11 for every gate line Lg in synchronization with switching of the source lines Ls. As a result, writing is performed in the order of the lines for every horizontal scan of the pixels.

Note that in each pixel cell 10a shown in FIG. 8, in addition to the configuration in FIG. 4, a first electrode is connected to a connection point of a drain of the TFT and a pixel electrode, and a second electrode has a held capacity 14 connected to the gate line Lg.

In the liquid crystal display apparatus 20, as the driving method of the liquid crystal, alternating driving wherein the voltage applied to the liquid crystal is inverted each field is preferable.

In the liquid crystal display panel, the number of connection points with an external circuit is the total of the amount of source lines of effective pixels on the horizontal drive circuit 24 side and about 10 pins for

the vertical drive circuit 23.

More specifically, for example, the number of connection points becomes 320 pins in a liquid crystal display panel having 100 x 100 effective pixels. Accordingly, it is possible to gather together the connection pins at only one side of the four-sided liquid crystal display panel to mount an external circuit.

In the liquid crystal display apparatus 20, the vertical drive circuit 23 and the liquid crystal display area 22 are formed integrally on the glass substrate 21 by using low temperature polySi TFTs. Compared with high temperature polySi using a quartz glass substrate and requiring a 1000°C or more high temperature film-forming technique, low temperature polySi TFTs can be produced by a 450°C or less low temperature film forming technique, so a normal glass substrate can be used instead of a quartz glass substrate.

Accordingly, the liquid crystal display apparatus of the present invention can be produced at a low cost from this viewpoint as well.

Note that in the present invention, the TFTs formed by the low temperature polySi may be top gate types or bottom gate types.

Also, in the present invention, the horizontal drive circuit is connected to the liquid crystal display panel

substrate by COG. Thus, there is some degree of freedom in mounting compared with a case of connecting the horizontal drive circuit by TAB and also the LCD module can be made smaller.

As explained above, since the liquid crystal display apparatus of the present invention does not use a time sharing driving method and has the horizontal drive circuit as an external circuit, the image quality can be improved. Also, the yield of products is improved and production at a low cost can be attained. Particularly, the liquid crystal display apparatus of the present invention is advantageous as a medium- to small-sized liquid crystal display apparatus used for a PDA etc.

INDUSTRIAL APPLICABILITY

As explained above, according to the liquid crystal display panel of the present invention, an aging circuit is provided on a substrate of the liquid crystal display panel instead of an external horizontal drive circuit or a vertical drive circuit, so aging can be performed by the substrate of the liquid crystal display panel alone, potential panel defects can be found, and a high quality liquid crystal display panel can be supplied at a low cost.

Also, according to the liquid crystal display apparatus according to the present invention, since a

time sharing driving method is not used and a horizontal drive circuit is provided as an external circuit, the image quality can be improved, the yield of products is improved, and production at a low cost can be attained.

CLAIMS

1. A liquid crystal display panel comprising an active matrix display area, a vertical drive circuit, and a horizontal aging circuit for supplying signals to a plurality of source lines at one time provided on a substrate of the liquid crystal display panel and a horizontal drive circuit connected outside.

2. A liquid crystal display panel comprising an active matrix display area, a horizontal drive circuit, and a vertical aging circuit for supplying signals to a plurality of gate lines at one time provided on a substrate of the liquid crystal display panel and a vertical drive circuit connected outside.

3. A liquid crystal display panel comprising an active matrix display area, a horizontal aging circuit for supplying signals to a plurality of source lines at one time, and a vertical aging circuit for supplying signals to a plurality of gate lines at one time provided on a substrate of the liquid crystal display panel and a horizontal drive circuit and a vertical drive circuit connected outside.

4. A liquid crystal display panel as set forth in claim 1, wherein a horizontal aging circuit or a vertical aging circuit gathers together a plurality of source lines or gate lines via CMOS switches, NMOS switches, or

PMOS switches and supplies signals to the collected lines.

5. A liquid crystal display panel as set forth in claim 2, wherein a horizontal aging circuit or a vertical aging circuit gathers together a plurality of source lines or gate lines via CMOS switches, NMOS switches, or PMOS switches and supplies signals to the collected lines.

6. A liquid crystal display panel as set forth in claim 3, wherein a horizontal aging circuit or a vertical aging circuit gathers together a plurality of source lines or gate lines via CMOS switches, NMOS switches, or PMOS switches and supplies signals to the collected lines.

7. A method of producing a liquid crystal display panel comprising an active matrix display area, a vertical drive circuit, and a horizontal aging circuit for supplying signals to a plurality of source lines at one time provided on a substrate of the liquid crystal display panel and a horizontal drive circuit connected outside, said method of producing a liquid crystal display planel comprising forming the horizontal aging circuit in a process of forming the active matrix display area on the substrate.

8. A method of producing a liquid crystal display

panel comprising an active matrix display area, a horizontal drive circuit, and a vertical aging circuit for supplying signals to a plurality of gate lines at one time provided on a substrate of the liquid crystal display panel and a vertical drive circuit connected outside, said method of producing a liquid crystal display planel comprising forming the vertical aging circuit in a process of forming the active matrix display area on the substrate.

9. A method of producing a liquid crystal display panel comprising an active matrix display area, a horizontal aging circuit for supplying signals to a plurality of source lines at one time, and a vertical aging circuit for supplying signals to a plurality of gate lines at one time provided on a substrate of the liquid crystal display panel and a horizontal drive circuit and a vertical drive circuit connected outside, said method of producing a liquid crystal display planel comprising forming the horizontal aging circuit and the vertical aging circuit in a process of forming the active matrix display area on the substrate.

10. A liquid crystal display apparatus of an active matrix type, wherein

a vertical drive circuit is formed integrally with a liquid crystal display area on a glass substrate

by using low temperature polySi TFTs, a horizontal drive circuit is connected to a liquid crystal display panel substrate by COG, and output terminals of a driver IC constituting the horizontal drive circuit and source lines are in a one-to-one correspondence.

ABSTRACT

A liquid crystal display panel 1, to which an external horizontal drive circuit is connected in a TAB, COG, or other form, capable of performing aging by a substrate alone when image display is possible by connecting the external drive circuit, comprising an active matrix display area 2, a vertical drive circuit 4, and a horizontal aging circuit 5 for supplying signals to a plurality of source lines at one time provided on a substrate 3.

Also, a medium- to small-sized active matrix type liquid crystal display apparatus used for a PDA etc. able to be produced at a high quality and a low cost without using a time sharing driving method and provided with a horizontal drive circuit as an external circuit, wherein a vertical drive circuit is formed integrally with a liquid crystal display area on a glass substrate by using low temperature PolySi TFTs, a horizontal drive circuit is connected to a liquid crystal display panel substrate by COG, and output terminals of a driver IC constituting the horizontal drive circuit and source lines Ls are in a one-to-one correspondence.

FIG.1

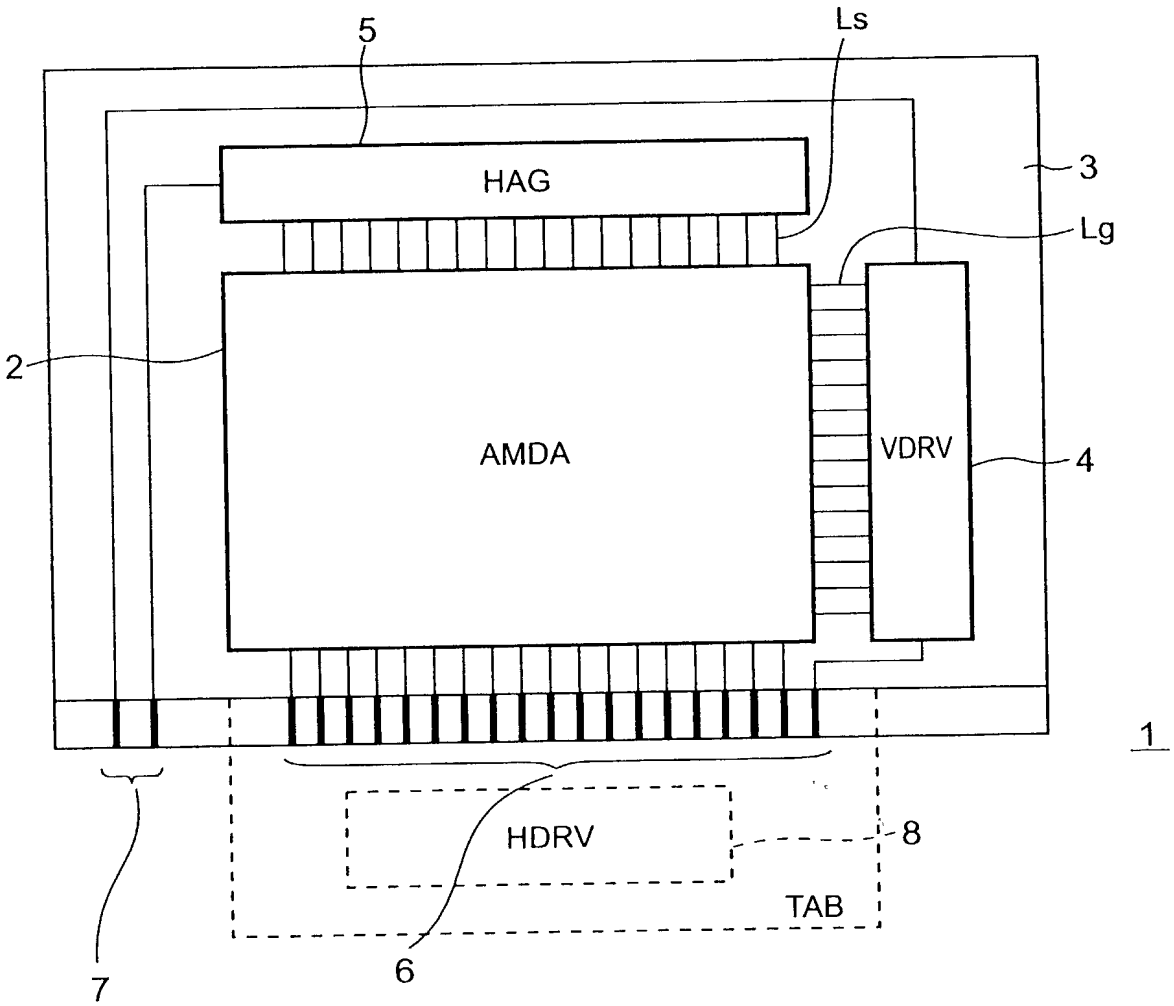
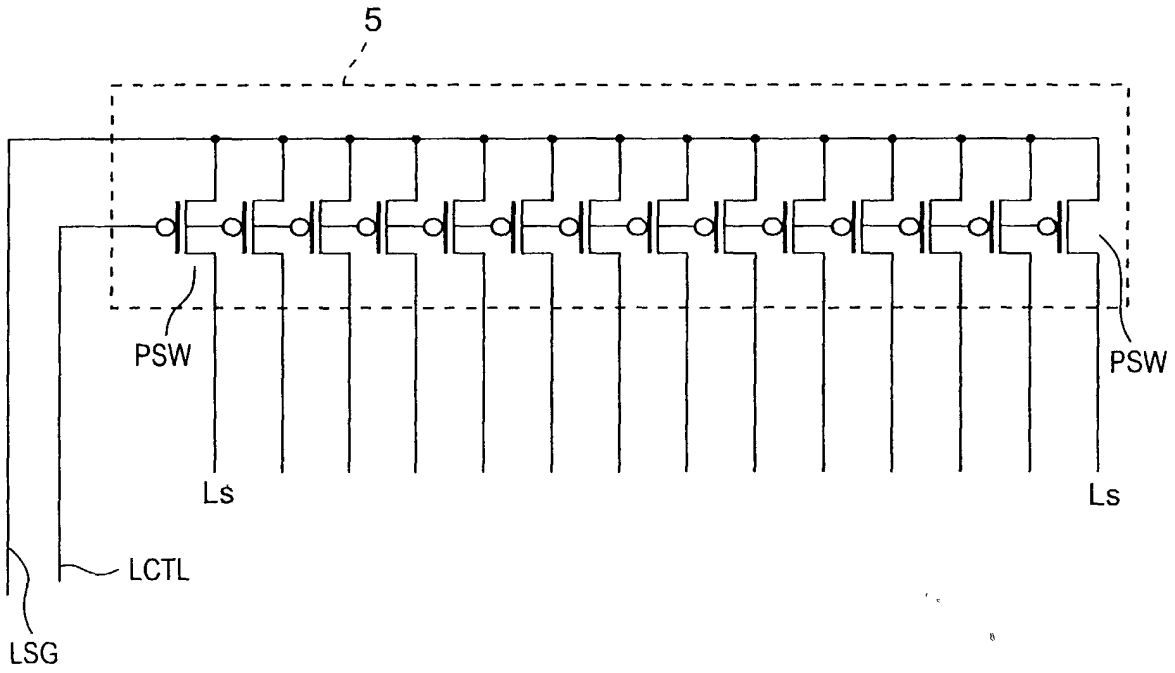


FIG.2



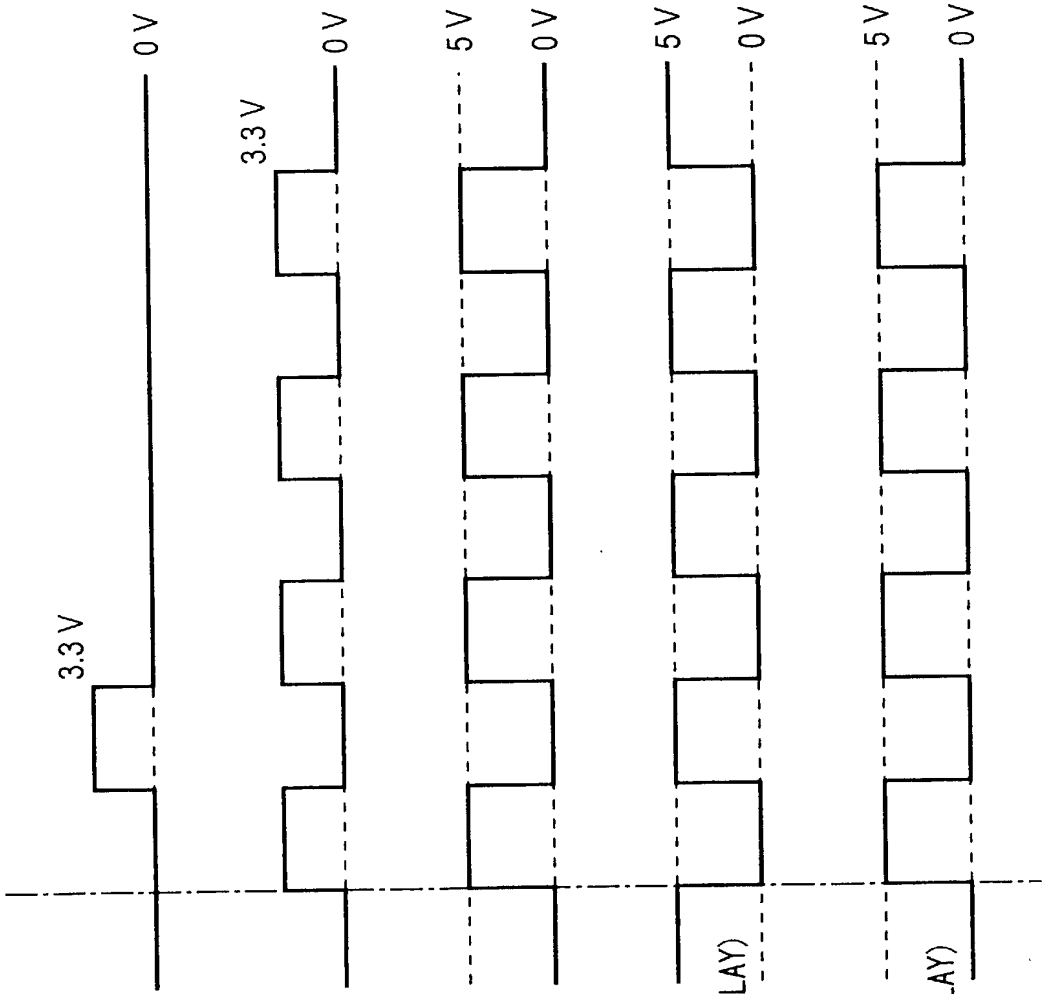


FIG.3A VST

FIG.3B VCK

FIG.3C VCOM

FIG.3D SIG (BLACK DISPLAY)

FIG.3E SIG (WHITE DISPLAY)

FIG.4

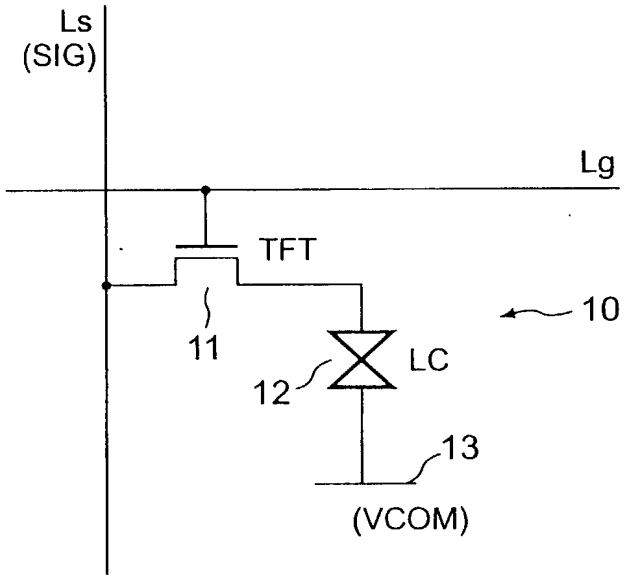


FIG.5

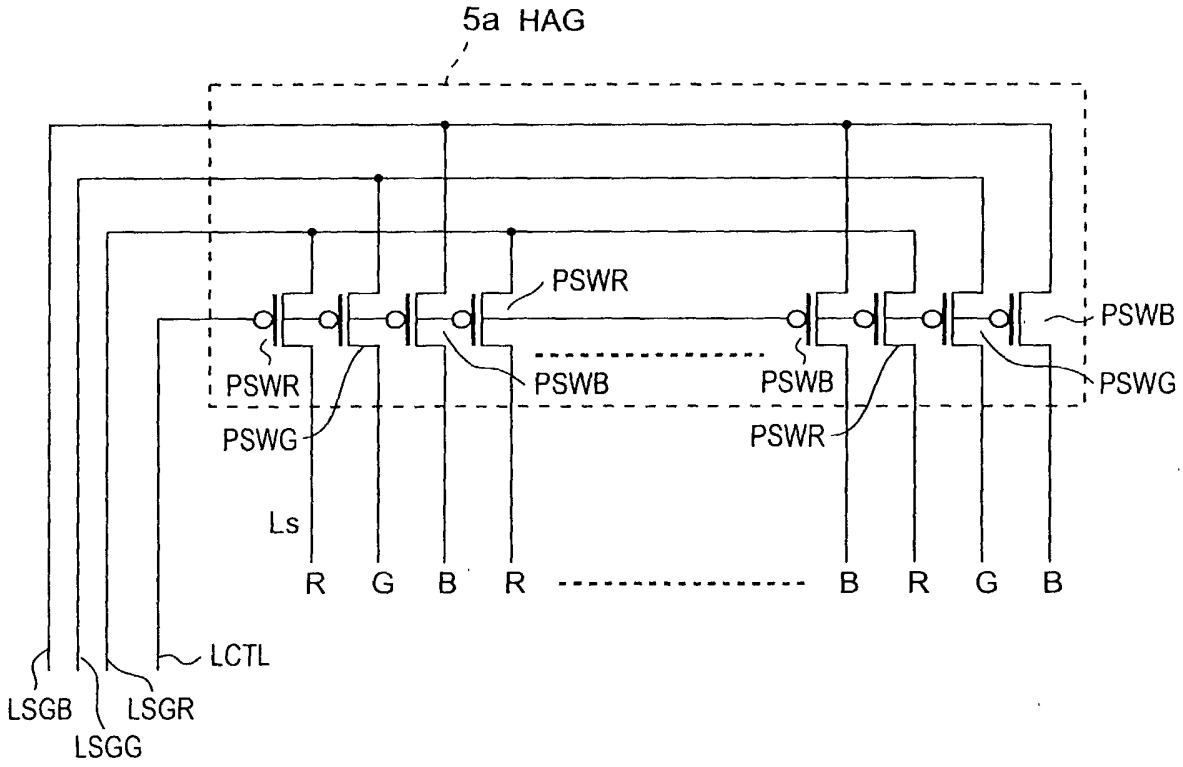

5a HAG
PSWR
PSWB
PSWR
PSWB
PSWB
PSWG
PSWG
PSWR
Ls
R G B R B R G B
LCTL
LSGB
LSGR
LSGG

FIG.6

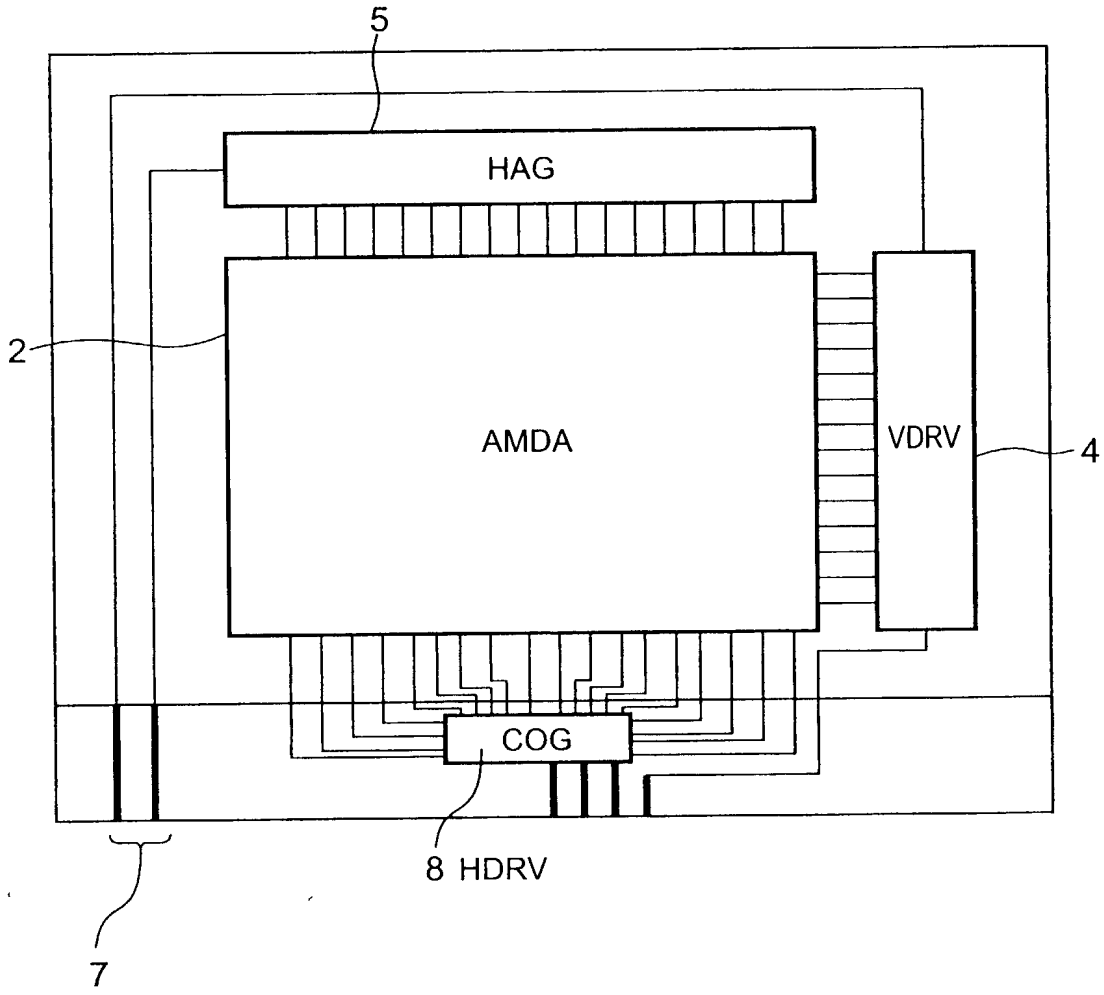


FIG.7

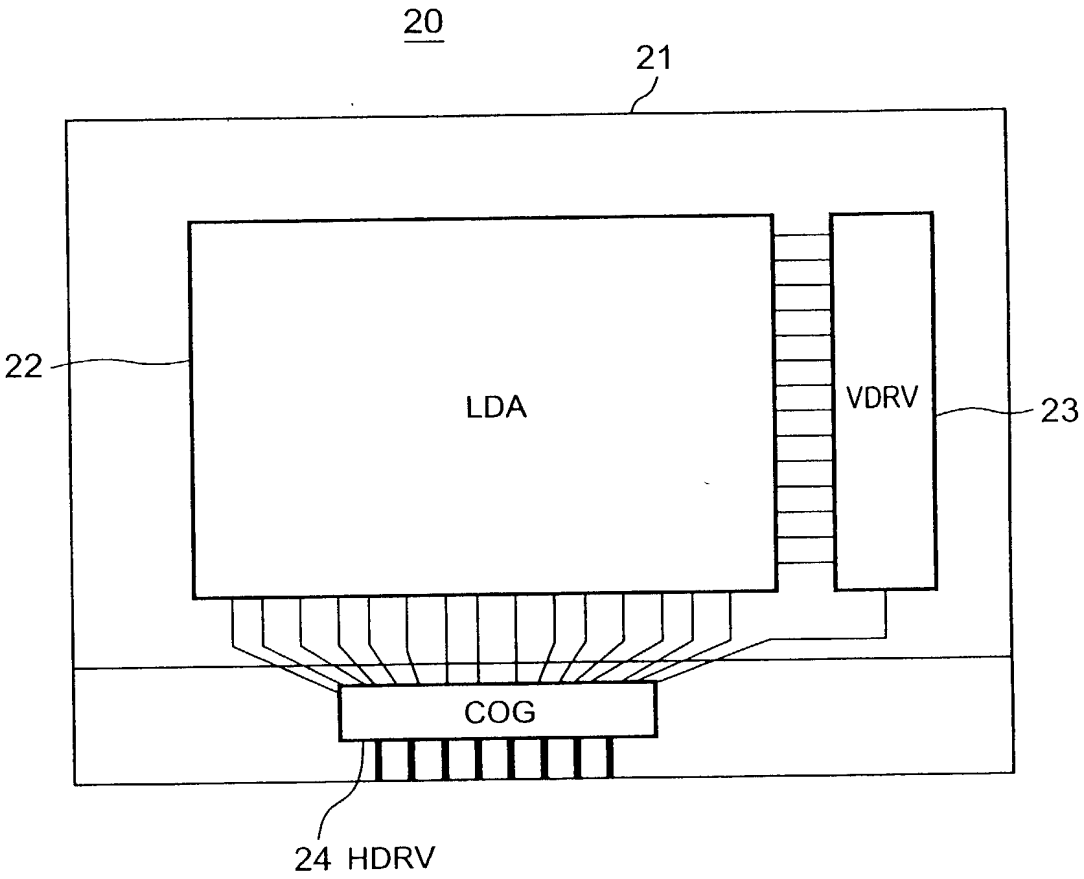
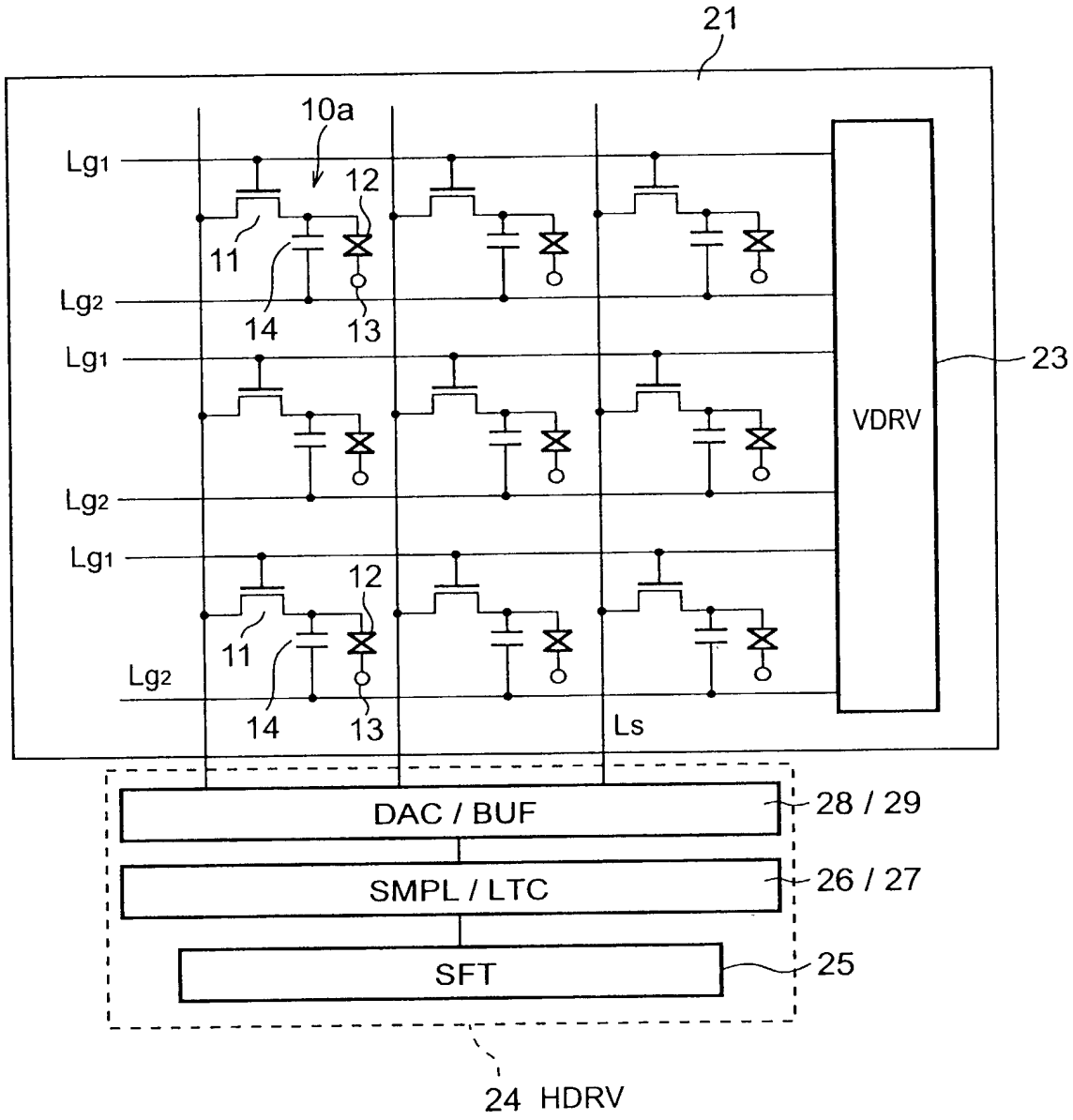


FIG.8


21
10a
Lg1
12
11
Lg2
14
13
Lg1
Lg2
Lg1
12
11
Lg2
14
13
Ls
VDRV
23
DAC / BUF
28 / 29
SMPL / LTC
26 / 27
SFT
25
24 HDRV

EXPLANATION OF REFERENCE NUMERALS

1... liquid crystal display panel

2... active matrix display area (AMDA)

3... glass substrate

4... vertical drive circuit (VDRV)

5, 5a... horizontal aging circuit (HAG)

6... first pad region

7... second pad region

8... horizontal drive circuit (HDRV)

Lg... gate line

Ls... source line

10, 10a... pixel cell

11... TFT

12... liquid crystal element

13... counter electrode

14... held capacity

20... liquid crystal display apparatus

21... glass substrate

22... liquid crystal display area (LDA)

23... vertical drive circuit (VDRV)

24... horizontal drive circuit (HDRV)

25... shift register circuit (SFT)

26... sampling circuit (SMPL)

27... latch circuit (LTC)

28... digital/analog conversion circuit (DAC)

29... output buffer circuit (BUF)

S01P1056 U.S.00

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

☐ Declaration submitted with or initial filing

☐ Declaration submitted after initial filing

Attorney Docket No.	SON 2166/SOH
First Named Inventor	Yoshitoshi KIDA et al.
COMPLETE IF KNOWN	
Application No.	10/089,230
Filing Date	March 28, 2002
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (only if one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

LIQUID CRYSTAL DISPLAY PANEL AND PRODUCTION METHOD OF THE SAME AND LIQUID CRYSTAL DISPLAY APPARATUS

(Title of the Invention)

the specification of which

☐ is attached hereto

or

☐ was filed on 07/30/2001 as United States Application Number or PCT International Application Number: PCT/JP01/06547 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119 (a)-(d) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YY)	Priority Not Claimed	Certified Copy Attached YES	Certified Copy Attached NO
2000-230993	Japan	07/31/2000		☐	☐
2000-231013	Japan	07/31/2000		☐	☐
				☐	☐
				☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

Application Number (s)	Filing Date (MM/DD/YY)	☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

Please type a plus sign in this box: [+]

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DECLARATION - Utility Or Design Patent Application

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the matter provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☒ Customer Number 23353

or

☐ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number
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H. Lawrence Smith	24,900	Richard D. Grauer	22,388
Ralph T. Rader	28,772	Michael D. Fishman	31,951
Joseph V. Coppola, Sr.	33,373	Mark A. Davis	37,118
Michael B. Stewart	36,018	Stefan V. Chemielewski	39,914
Alexander D. Rabinovich	37,425	Kristin L. Murphy	41,212
Kevin D. Rutherford	40,412	David K. Benson	42,314
Glenn E. Forbis	40,610	Christopher M. Tanner	41,518
Ronald P. Kananen	24,104	Robert S. Green	41,800
Matthew J. Russo	41,282	Brian K. Dutton	47,255
G. Thomas Williams	42,228		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to ☒ Customer Number or Bar Code Label 23353 or ☐ Correspondence Address below

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of First Inventor ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
Yoshitoshi	KIDA

Inventor's Signature	Yoshitoshi Kida					**Dated**	March 15, 2002
Residence: City	Kanagawa	**State**		**Country**	Japan	**Citizenship**	Japan
Post Office Address	c/o Sony Corporation 7-35, Kitashinagawa 6-chome, Shinagawa-ku,						
City	Tokyo	**State**		**Zip**	141-0001	**Country**	Japan

1-00

Name of Second Inventor ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
Yoshiharu	NAKAJIMA

Inventor's Signature	Yoshiharu Nakajima					**Dated**	March 18, 2002
Residence: City	Kanagawa	**State**		**Country**	Japan	**Citizenship**	Japan
Post Office Address	c/o Sony Corporation 7-35, Kitashinagawa 6-chome, Shinagawa-ku,						
City	Tokyo	**State**		**Zip**	141-0001	**Country**	Japan

2-00

Name of Third Inventor	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])				Family Name or Surname			
Naoshi				GOTO			
Inventor's Signature	Naoshi Goto JPX				Dated	March 18, 2002	
Residence: City	Kanagawa	State		Country	Japan	Citizenship	Japan
Post Office Address	c/o Sony Corporation 7-35, Kitashinagawa 6-chome, ~~xxxxxxxxxxxx~~ Shinagawa-ku,						
City	Tokyo	State		Zip	141-0001	Country	Japan

Name of Forth Inventor	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])				Family Name or Surname			
Toshikazu				MAEKAWA			
Inventor's Signature	Toshikazu Maekawa JPX				Dated	March 18, 2002	
Residence: City	Kanagawa	State		Country	Japan	Citizenship	Japan
Post Office Address	c/o Sony Corporation 7-35, Kitashinagawa 6-chome, ~~xxxxxxxxxxxx~~ Shinagawa-ku,						
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Name of Fifth Inventor	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])				Family Name or Surname			
Hideo				KATAOKA			
Inventor's Signature	Hideo Kataoka JPX				Dated	25/3/2002	
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City	Tokyo	State		Zip	141-0001	Country	Japan

Name of Sixth Inventor	☐ A petition has been filed for this unsigned inventor						
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Inventor's Signature					Dated		
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Post Office Address							
City	Shinagawa-Ku	State		Zip		Country	

Name of Seventh Inventor	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature					Dated		
Residence: City	i	State		Country		Citizenship	
Post Office Address							
City		State		Zip		Country	

Name of Eighth Inventor	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature					Dated		
Residence: City		State		Country		Citizenship	
Post Office Address							
City		State		Zip		Country	